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Saturday, July 20, 2013

A very underrated invention

Perhaps the most underrated invention in history is the humble hourglass. Invented in Europe during the late 13th or early 14th century, the sand glass complemented a nearly simultaneous invention, the mechanical clock. The mechanical clock with its bell was a centralized way of broadcasting the hours day and night; the sand glass was a portable way of measuring shorter periods of time. These clocks were made using very different and independent techniques, but their complementarity function led to their emergence at the same time and place in history, late medieval Europe.

The sandglass was more portable than a water clock. Since its rate of flow is independent of the depth of the upper reservoir, it was also more accurate. And, important in northern Europe, it didn't freeze in winter.

> An advancing technology in 13th century western Europe very different from mechanics was glass-blowing. The origin of the sandglass is quite obscure, but its accuracy relies on a precise ratio between the neck width and the grain diameter. It thus required extensive trial and error for glass-blowers to arrive at hour glasses for sand, ground marble, eggshell, and other sized grains, and techniques for mass producing these precisely sized works of glass, besides a ready of market of users, which Europe turned out to be.

> > There are no demonstrated cases of sandglasses before the 14th century. Manufacture and use of the sand-glass was widespread in western Europe by the middle of the 14th century. In 1339 Ambrosio Lorenzetti painted a fresco in Siena, one of the commercial cities of northern Italy, which shows a sandglass as an allegory for temperance (self-control). Mariners in the Mediterranean were likely using sandglasses to measure time and velocity by 1313. By 1394 French housewives were using recipes to make, along with food, glue, ink, and so on, marble grains for an hour-glass:
>
> > "Take the grease which comes from the sawdust of marble when those great tombs of black marble be sawn, then boil it well in wine like a piece of meat and skim it, and then set it out to dry in the sun; and boil, skim and dry nine times; and thus it will be good."
>
> > Such a recipe presumably creates grains of a size in a precise ratio to a standard hour-glass neck size, thus producing an accurate time.

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Nick Szabo

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The sandglass, not the mechanical clock, became between the 13th and 16th centuries the main European timekeeper in activities as diverse as public meetings, sermons, and academic lectures. It was also the main navigational and scientific clock during that period. [*]

From the point of view of later engineers, the mechanical clock was the more important invention -- they were on the cutting edge of technology from the time of their invention until the industrial revolution. However,

> For contemporaries....the sandglass was equally or more important. Until the widespread use of small table-top mechanical clocks, the sandglass was the primary means of fair timekeeping. The sand glass was visible to all in a room, and it could only be dramatically and obviously "reset", it couldn't be fudged like a mechanical clock. [*]

As I detail here, the sand glass also played an essential role in the technique of dead reckoning for ocean navigation, also developed in late medieval Europe. A strict regimen of turning the glasses was kept non-stop throughout a voyage:

> During the voyage of Ferdinand Magellan around the globe, his vessels kept 18 hourglasses per ship. It was the job of a ship's page to turn the hourglasses and thus provide the times for the ship's log. Noon was the reference time for navigation, which did not depend on the glass, as the sun would be at its zenith.[8] More than one hourglass was sometimes fixed in a frame, each with a different running time, for example 1 hour, 45 minutes, 30 minutes, and 15 minutes. [*]

Arab and Chinese navigators lacked this crucial piece, and thus by the time of the exploration explosion had not developed navigation techniques that could rival those of Western Europe.

Posted by Nick Szabo at 1:12 PM

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